Original Research Paper

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ROCURONIUM VERSUS SUCCINYL CHOLINE FOR RAPID SEQUENCE INDUCTION AND INTUBATION

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ABSTRACT **Background:** Maintenance of a patent airway is a basic and essential component of general anaesthesia through endotracheal intubation. Muscle relaxants are useful in providing adequate relaxation to enable laryngoscopy and intubation. Succinylcholine and Rocuronium are used.

Objectives: 1) To evaluate whether reducing the intubating dose of Rocuronium shortens its duration of action at the same time providing clinically acceptable intubating conditions.
2) To compare effectiveness of Rocuronium and Succinylcholine.

Methodology: This is a hospital based experimental study involving a total of 100 patients ASRAMS, ELURU. Patients of either gender aged between 18 to 65 years who were willing to volunteer for the study and who have given written and informed consent are included. Patients were randomly allocated to one of 5 groups using a computer-generated randomization table. Statistical analysis of the data obtained was done using SPSS version 16 trail.

Results: The overall intubating conditions in the 5 groups, using the Pearson Chi square test, a significant difference was noted in intubating conditions in the different groups with a P value < 0.0001.The onset of neuromuscular blockade was fastest in the Succinylcholine group, followed by the Rocuronium 0.6 group and Rocuronium 0.3 group, using the Mann-Whitney test with P value < 0.0001.The longest duration of neuromuscular blockade was in Rocuronium 0.6 group with P < 0.0001.

Conclusion: Rocuronium in a dose of 0.3 mg/kg does not give clinically acceptable intubating conditions at 60 or 90 seconds. Rocuronium in a dose of 0.6 mg/kg gives clinically acceptable intubating conditions at 60 or 90 seconds that are comparable to intubation at 60 seconds following succinylcholine 1 mg/kg. Reducing the dose of rocuronium to 0.3 mg/kg shortens the duration of action but at the expense of providing clinically unacceptable intubating conditions.

KEYWORDS : Comparison, Induction, Intubation, Rocuronium, Succinylcholine

Introduction:
Maintenance of a patent airway is a basic and essential component of general anaesthesia. Endotracheal intubation is one of the means of doing so in conventional anaesthetic practice. Muscle relaxants are useful in providing adequate relaxation to enable laryngoscopy and intubation. Succinylcholine is still preferred over other muscle relaxants for producing rapid muscle relaxation prior to endotracheal intubationand short apnea time are special attributes useful in patients with high gastric volume.

Rocuronium, has shown in multiple studies to have an onset of action of less than 1 minute.[3-7]

It is expected to have an onset time as rapid as that of succinylcholine without its adverse effects.Rocuronium has little or no adverse cardiovascular effects, nor does it cause histamine release. For these reasons, it may be preferred to succinylcholine. However, rocuronium has an intermediate duration of action of 25 to 30 minutes.

AIM &OBJECTIVES:
1) To evaluate whether reducing the intubating dose of Rocuronium shortens its duration of action at the same time providing clinically acceptable intubating conditions.
2) To compare effectiveness of Rocuronium and Succinylcholine.

MATERIALS AND METHODS:
Methods of collection of data: This is a Hospital based study involving a total of 100 patients ASRAMS, ELURU.

Inclusion criteria:
1) Patients of either gender aged between 18 to 65 yearsbelonging to the American Society of Anesthesiologists Physical Status (ASA PS) 1 or 2 scheduled for elective surgery were included in the study.
2) Patients who were willing to volunteer for the study and who have given Written and informed consent are included.

Exclusion criteria:
1) Potential or manifest airway problems,
2) Modified Mallampati class 3 or 4,
3) Presence of neuromuscular disease,
4) Need for rapid sequence induction,
5) Pregnancy,
6) Upper limb surgery,
7) Aminoglycoside antibiotic administration in the previous 24 hours,
8) History of allergy to drugs used.

Randomization, blinding and group allocation: Patients were randomly allocated to one of 5 groups using a computer-generated randomisation table.

Group R3/60: Patients received intravenous rocuronium0.3 mg/kg body weight and were intubated at 60 seconds.

Group R3/90: Patients received intravenous rocuronium 0.3 mg/kg body weight and were intubated at 90 seconds.

Group R6/60: Patients received intravenous rocuronium 0.6 mg/kg body weight and were intubated at 60 seconds.

Group R6/90: Patients received intravenous rocuronium 0.6 mg/kg body weight and were intubated at 90 seconds.

Group S/60: Patients received intravenous succinylcholine 1.0 mg/kg body weight and were intubated at 60 seconds.

Statistical analysis of the data obtained was done using SPSS version

16 trail. Chi-square test, ANOVA, Mann-Whitney U test is applied and P < 0.05 was considered significantand results shown as tables and graphs.

RESULTS:

1. Intubating conditions:

A) Laryngoscopy: Conditions for laryngoscopy were compared and graded as easy, fair or difficult. Using the Pearson Chi square test, a significant difference was noted among the 5 groups with a P value of 0.002.

Group	Easy	Fair	Difficult	Total
R3/60	12	7	1	20
R3/90	19	0	1	20
R6/60	17	3	0	20
R6/90	19	1	0	20
S/60	20	0	0	20

B) Vocal cord position: The position of the vocal cords at laryngoscopy was compared in the 5 groups. Using Pearson Chi square test, a significant difference was noted among the 5 groups, with the P value being 0.014.

Group	Abducted	Intermediate	Closed	Total
R3/60	10	9	-	19
R3/90	11	8	1	20
R6/60	16	4	0	20
R6/90	18	2	0	20
S/60	19	1	0	20

C) Reaction to intubation: The reaction to intubation was compared in the 5 groups. Using the Pearson Chi square test, a significant difference was noted with the P value <0.0001.

Group	None	Slight(1-2 contractions or <5 seconds)	Vigorous(>2 contractions or >5 seconds)	Total
R3/60	5	2	12	19
R3/90	6	6	8	20
R6/60	8	8	4	20
R6/90	20	0	0	20
S/60	19	0	1	20

D) Overall intubating conditions: The overall intubating conditions in the 5 groups, using the Pearson Chi square test, a significant difference was noted in intubating conditions in the different groups with a P value < 0.0001.

Group	Excellent (clinically acceptable)	Good (clinicallyac ceptable)	Poor (clinically not acceptable)	Total
R3/60	2	5	13	20
R3/90	5	7	8	20
R6/60	6	10	4	20
R6/90	17	3	0	20
S/60	18	1	1	20

E) Intubating conditions - Clinically acceptable versus Clinically not acceptable:

Group	Clinically Acceptable	Clinically not acceptable	Total
R3/60	7	13	20
R3/90	12	8	20
R6/60	16	4	20
R6/90	20	0	20
S/60	19	1	20

*Pearson Chi square test : P <0.0001

F) Comparison of intubating conditions between different groups: The comparison of intubating conditions in the R3/60 and R6/60 groups. Using the Pearson Chi square test, a significant difference was noted between the 2 groups with regard to incubating conditions show P value of 0.005

Comparison of intubating conditions between R3/60 and R6/60groups

Group	Clinically acceptable	Clinically not acceptable	Total
R3/60	7	13	20
R6/60	16	4	20
Total	23	17	20

*Pearson Chi square test : P <0.005

2. Onset and duration of neuromuscular blockade: The number of patients in whom the train-of-four count (TOF count) was 0 within 10 minutes of administering the neuromuscular blocker.

Group	TOF count = 0 before 10 minutes	TOF not completely abolished at 10 minutes	Total
R3/60	7	13	20
R3/90	9	11	20
R6/60	20	0	20
R6/90	20	0	20
S/60	20	0	20

The onset and duration of action was calculated only in those patients who had a TOF count of 0 within 10 minutes of administering the neuromuscular blocker.

Onset of neuromuscular blockade (T_1)

Group	Median time Seconds (minutes)	Interquartile range Seconds (minutes)
R3/60	235 (3.91)	60 (1.00)
R3/90	426 (7.10)	175 (2.91)
R6/60	165.5 (2.75)	28.5 (0.47)
R6/90	126 (2.10)	63.50 (1.05)
S/60	65 (1.08)	24 (0.4)

Duration of neuromuscular blockade (T_2)

Group	Median timeSeconds (minutes)	Interquartile range Seconds (minutes)
R3/60	1260 (21)	660 (11)
R3/90	840 (14)	1290 (21.50)
R6/60	2850 (47.5)	1140 (19)
R6/90	3090 (51.5)	1635 (27.5)
S/60	420 (7.0)	180(3)

To determine the onset and duration of neuromuscular blockade of low dose rocuronium, the groups R3/60 and R3/90 were combined into a single group, the Rocuronium 0.3 group. Similarly, the groups R6/60 and R6/90 were combined to constitute the Rocuronium 0.6 group. Group S/60 was named Succinylcholine group.

Onset of neuromuscular blockade (T1) (combined data)

Group	Median time Seconds (minutes)	Interquartile range Seconds (minutes)
Rocuronium 0.3	305 (5.08)	258.25 (4.30)
Rocuronium 0.6	156.00 (2.60)	54.5 (0.91)
Succinylcholine	65 (1.08)	24 (0.40)

*Mann-Whitney test-Kruskal Wallis : P < 0.0001

The onset of neuromuscular blockade was fastest in the Succinylcholine group, followed by the Rocuronium 0.6 group and Rocuronium 0.3 group. Using the Mann-Whitney test (Kruskal–Wallis one-way analysis of variance), the onset time (T_1) was noted to be statistically significant between the 3 groups, Rocuronium 0.3, Rocuronium 0.6 and Succinylcholine groups. (P < 0.0001).

Duration of neuromuscular blockade (T2) (combined data)

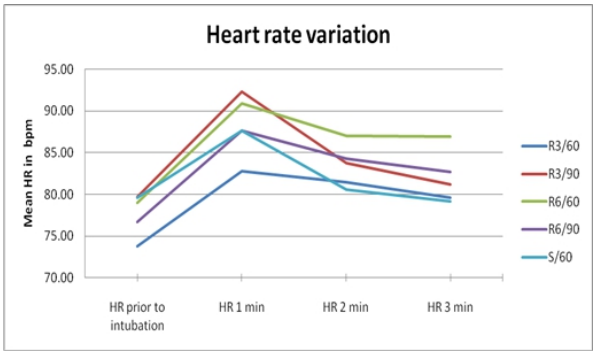
Group	Median timeSeconds (minutes)	Interquartile range Seconds (minutes)
Rocuronium 0.3	1110 (18.5)	795 (13.25)
Rocuronium 0.6	2880 (48.0)	1185 (19.75)
Succinylcholine	420 (7)	180 (3.0)

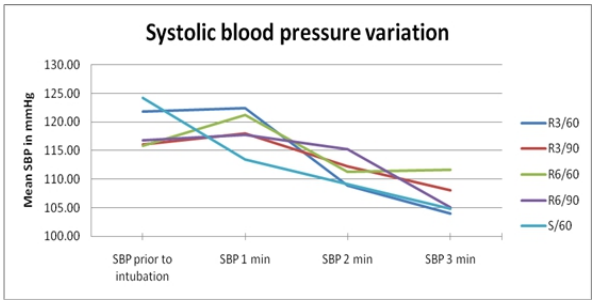
The longest duration of neuromuscular blockade was in Rocuronium

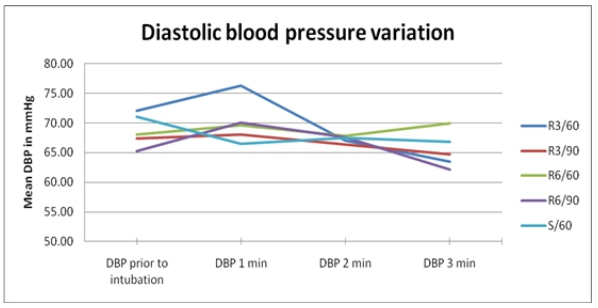
0.6 group and the shortest duration of neuromuscular blockade was in the Succinylcholine group. Reducing the dose of rocuronium to 0.3 mg/kg resulted in a decrease in the duration of neuromuscular blockade to 1110 seconds which was much lower than the duration of neuromuscular blockade seen in the rocuronium 0.6 mg/kg group (2880 seconds).

Using the Mann-Whitney test (Kruskal–Wallis one-way analysis of variance), the duration of action (T_2) was noted to be statistically significant between the 3 groups, Rocuronium 0.3, Rocuronium 0.6 and Succinylcholine groups. ($P < 0.0001$).

3. Heart rate and blood pressure changes:







DISCUSSION:

The purpose of the present study was to evaluate intubating conditions when performed at 60 or 90 seconds (irrespective of the train-of-four count at that point of time) following administration of low doses of rocuronium 0.3 mg/kg or 0.6 mg/kg. It was also proposed to study the onset and duration of action of these lower doses of rocuronium. Randomization and blinding were done in the study to ensure homogenous distribution among the groups and to avoid any possible bias.

In our study 12/20 patients in the R3/60 group and 19/20 patients in R3/90 group had easy laryngoscopy. Vocal cords were abducted in 10/20 patients in R3/60 group and 11/20 patients in R3/90 group. Reaction was vigorous in 12/20 patients in the R3/60 group and in 8/20 patients in R3/90 group. Thus in our study, only 7/20 (35%) patients in the R3/60 group and 12/20 (60%) in the R3/90 group had clinically acceptable overall intubating conditions.

The results of our study reveal that only 2/20 patients (10%) in the R3/60 group and 5/20 patients (25%) in the R3/90 group had excellent intubating conditions. Excellent intubating conditions were obtained in 17/20 patients (85%) in R6/90 group, making it comparable to 18/20 patients (90%) in the S/60 group. This was in contrast to the findings in the study done by Tullock W*et al* where they found good to excellent intubating scores in 100% patients given rocuronium 350 µg/kg and intubated at 150 s following anaesthetic induction with alfentanil and propofol.[1]

The train-of-four count came to 0 within 10 minutes in only 7/20 patients in the R3/60 group and in 9/20 patients in the R3/90 group; that is a total of 16/40 patients who were given rocuronium 0.3 mg/kg. However the vocal cords were abducted or intermediate in 19/20 patients in R3/60 group and also in 19/20 patients in R3/90 group (total in 38/40 patients). This shows that even though the TOF count at adductor pollicis may not be 0, the vocal cords were paralysed by then. The onset of action of rocuronium was faster at the vocal cords than at the adductor pollicis.

This is in agreement with the study on rocuronium done by Meistelman C *et al* where the onset time and intensity of block were less at the larynx compared to adductor pollicis.[2]

However in our study, the median onset time of neuromuscular blockade in R 0.3 group was 5.08 minutes (305seconds), which was much more than in the study done by Meistelman C*et al*.[2] In their study, the onset time at adductor pollicis using 0.3 mg/kg rocuronium was 3.0 ± 0.3 minutes.

CONCLUSIONS: Following anaesthetic induction with fentanyl, propofol and isoflurane in oxygen:

1. Rocuronium in a dose of 0.3 mg/kg does not give clinically acceptable intubating conditions at 60 or 90 seconds
2. Rocuronium in a dose of 0.6 mg/kg gives clinically acceptable intubating conditions at 60 or 90 seconds that are comparable to intubation at 60 seconds following succinylcholine 1 mg/kg
3. Reducing the dose of rocuronium to 0.3 mg/kg shortens the duration of action but at the expense of providing clinically unacceptable intubating conditions.

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